

Review of "Effect of Horizontal Resolution on the Simulation of Tropical Cyclones in the Chinese Academy of Sciences FGOALS-f3 Climate System Model" by Jinxiao Li et al.

Anonymous Referee #1

Referee comment on "Effect of horizontal resolution on the simulation of tropical cyclones in the Chinese Academy of Sciences FGOALS-f3 climate system model" by Jinxiao Li et al., Geosci. Model Dev. Discuss., <https://doi.org/10.5194/gmd-2021-19-RC1>, 2021

In this study, the authors present the simulation of TCs in the FGOALS-f3 climate model. They use simulations at two different spatial resolutions to understand the impact of model resolution on TC simulation. I find the presentation not very good and highly disorganized. Also, the explanations provided are very rushed and hand-wavy. There's an over-emphasis on the role of MJO in TCs without first considering the basic large-scale environmental parameters governing TC formation and development first.

Line 25: Not sure what you mean by 'seasonal cycle of number of tropical cyclones increased by 50%'.

Line 55: Replace 'following half-century' with 'last few decades'

Line 60: Cite past studies that have used high-resolution coupled GCMs to simulate TCs (Kim et al., 2014; Small et al., 2014; Li and Srivier 2018; Scoccimarro et al., 2017; Balaguru et al., 2020).

Line 80: Replace 'controversial' with 'ambiguous'

Lines 67-87: This part could be better written and organized.

Lines 110-120: While the atmospheric component is described in detail, there is only a

one line statement about the other components, especially the ocean model. Since this is a coupled simulation, and TC development is a highly coupled phenomenon, the authors must provide details of the ocean model as well.

Lines 180-185: Is this due to positive SST biases in higher latitudes? It could also be the effect of steering flow being too strong in the North Atlantic and Northwest Pacific, which prevent TCs from making landfall.

Figure 4: Why focus on only North Atlantic and Northwest Pacific in a GCM? To me, the improvement obtained going from a 100 km model to a 25 km model is obvious and not very interesting. The authors can focus more on their results based on the high-resolution model and show global results instead of focusing on a couple of basins.

Line 200: The biggest increase in TC duration appears to be in the eastern Pacific. Why is this the case? Also, why is there an increase in TC lifetimes in general? Is it because of an increase in intensity? Or is it because of biases in steering flow?

Lines 210-220: Why doesn't the seasonal cycle improve much in the eastern Pacific unlike every other basin?

Figures 7 and 8: If the simulation is free-running and not forced, I'm not sure what the point is in this comparison. In fact, I'd say this is meaningless. The only thing perhaps one can compare is standard-deviation or a measure of interannual variability.

Figure 9: For observations, are you using the most intense TCs?

Section 4.1: The jump from the previous section to this is rather sudden. I suggest presenting the analysis of the large-scale environment first before getting into MJO, ENSO etc. Note that these phenomena only modulate TC activity.

Figures 10-13: While figures 10 and 11 do show that the high-resolution model has a better representation of the MJO, its connection to TCs is very hand-wavy and not clear to me. Also, in both figures 12 and 13, MJO seems to have little effect on TCs in the Southern Hemisphere, which is strange. If the authors are really keen on understanding the impact of MJO simulation on TCs, they should perform an analysis something like that shown in this study: <https://journals.ametsoc.org/view/journals/clim/27/6/jcli-d-13-00483.1.xml>

Figure 14: Expand the domain in the Atlantic all the way to the African coast and add panels for differences with observations. Although the GPI analysis is good, the way it is presented is not helping much. For instance, why is there a tendency in the model for a poleward shift in TCs? It's hard to see anything in the GPI analysis. What about SST biases?

Figure 16 and 17: Again, I don't understand the tendency of the authors to try and explain everything with MJO. There are other things besides it. For instance, what about African Easterly Waves in the Atlantic?

Tables 1-3: There's no information presented in the paper on the length of simulations, etc.